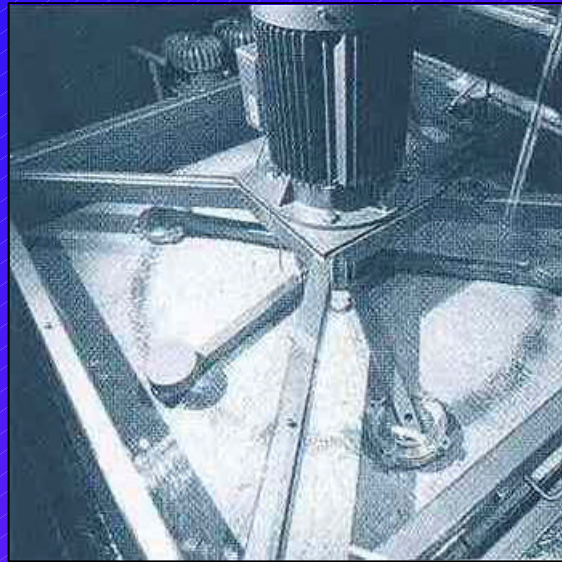


# Safety elements

## Clothes / Gloves / Shoes



### Advantages:

- No reduced mobility
- Wind and weather proof
- Respiration of clothes ⇒ **No body overheating**
- Materials with slight abrasion
- Materials with high stability and stable seams
- **Impact protection with protectors**

⇒ **High passive safety level**



# Safety elements

## Back Protector



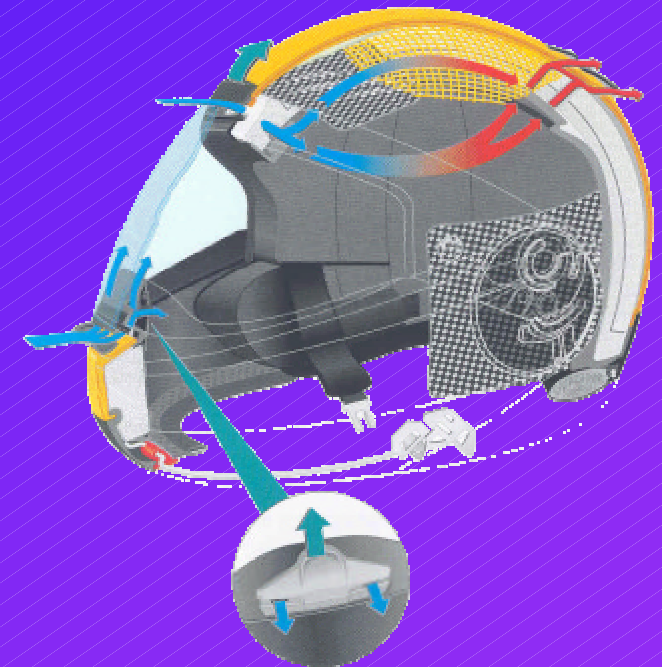
### Advantages:

- Good wearing comfort ⇒ **No reduction of mobility**
- Materials and seams with high stability
- **Impact Protection**  
⇒ **High level of passive safety**



# Safety elements

## Helmet



### Advantages:

- Minimal impact on the sense of hearing
- Good ventilation ⇒ **no fogging of the visor**
- Good ventilation ⇒ **good climatic conditions for the head**
- Minimal weight ⇒ **release of the neck**
- **Impact protection / high stability**  
⇒ **High active and passive safety level**

# Safety elements

## Rider Training



- International training
- Explicit focus on braking ⇒ **Optimal usage of the ABS system**
- No “banking” training
- Improved safety of riding  
⇒ **Reduced number of crashes**

# Safety elements

## Anti-Lock-Brake (ABS)



### Main Targets:

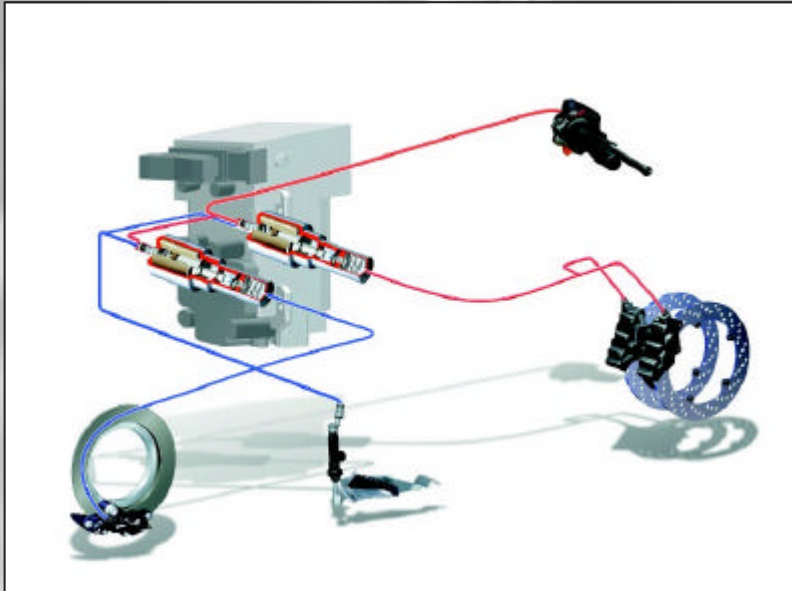
- Maximum deceleration ⇒ **Accident avoidance**
- No locking of the rear wheel ⇒ **Stable PTW**
- Accident avoidance caused by locked front wheel ⇒ **Vertical impact**
- No roll over ⇒ **Stable motorcycle.**



# Safety elements

## ABS

### Vollintegral / Teilintegral

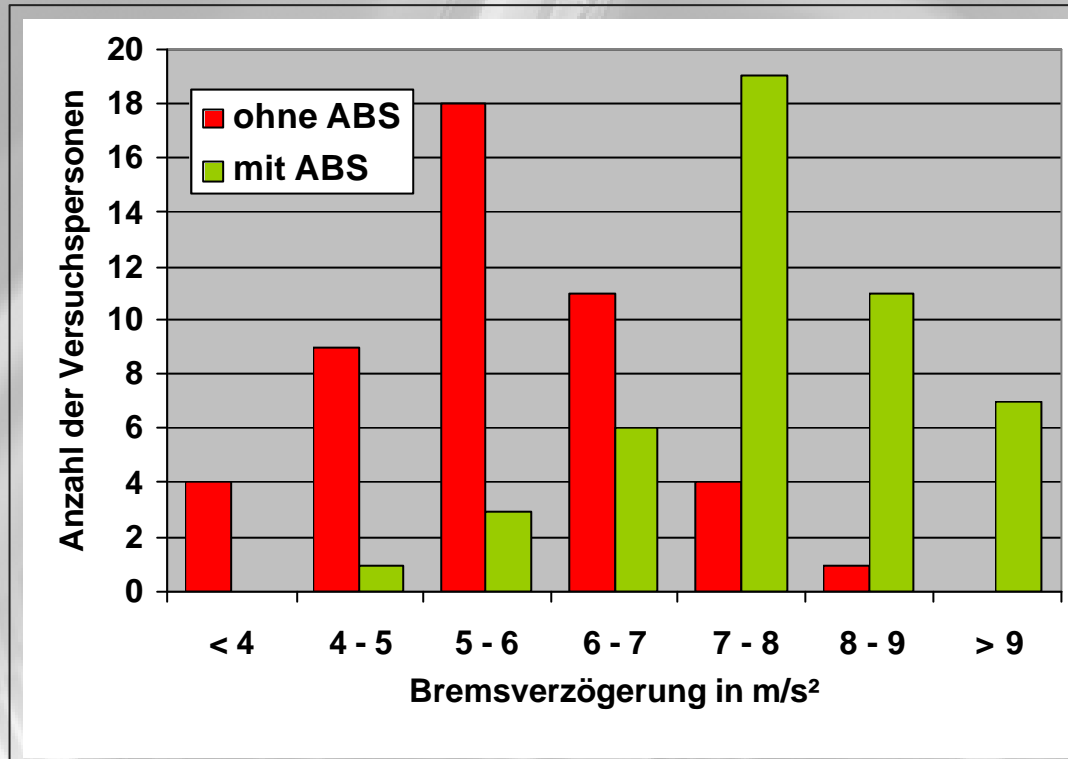


#### Advantages:

- Activation by one lever ⇒ **Both brakes are active**
- Optimal distribution of breaking force for front and rear wheel
- **Electronic brake force distribution** while riding (Load-dependent)
- Maximum cornering
- No rise of the rear wheel

# Safety elements

## ABS



### Implementation of the tests / Results:

- Average experienced rider
- Own MC without ABS ⇒ Explanation of ABS ⇒ ABS brake test  
⇒ **Improvement of brake performance in average 2,0m/s²**

# Safety elements

## ABS





# Agenda

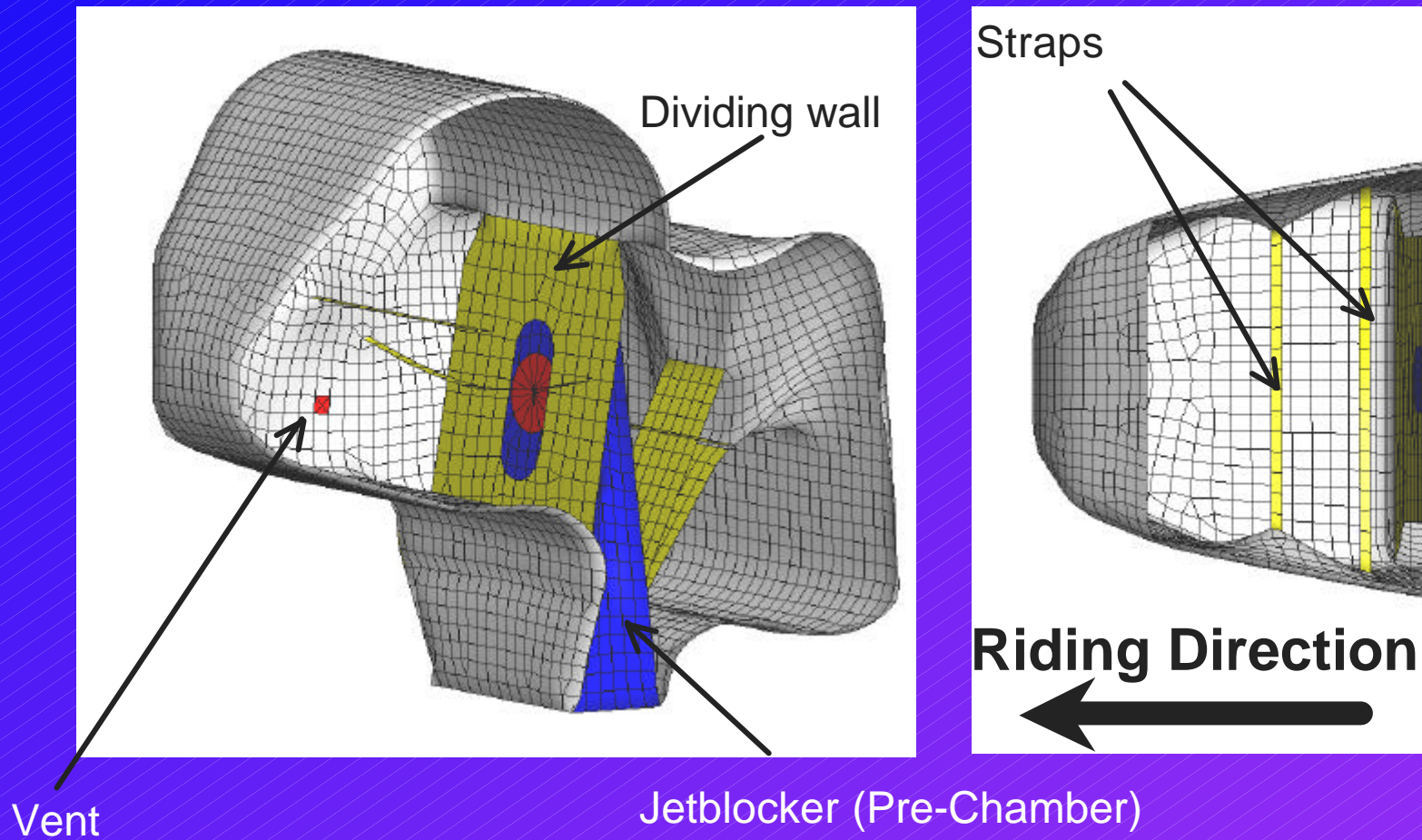
- Preliminary note
- Statistics
- ISO 13232
- Safety elements
- Research



# Motorcycle Airbag Research at BMW



# Motorcycle Airbag Research at BMW

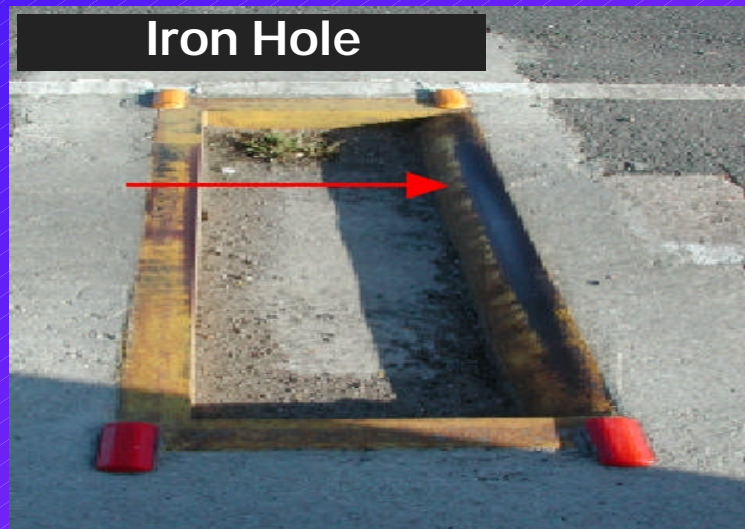




# Motorcycle Airbag Research at BMW

## Sensor Technology

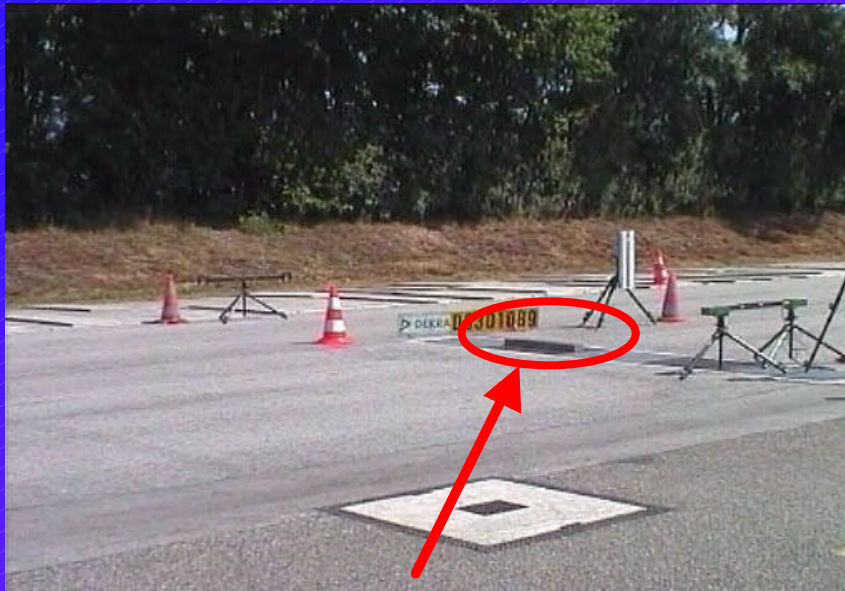
### Example for obstacles:



# Motorcycle Airbag Research at BMW

## Sensor Technology

### Real time video



Iron bar 6 cm  
134 km/h non-braked



Iron bar 6 cm

Result: Slight deformation of front wheel  
No ignition below 200% of peak level!



# Motorcycle Airbag Research at BMW

## Sensor Technology

Iron bar  
15 cm  
30,2 km/h  
Non-braked



Real time video



Result: Severe deformation of front wheel, fracture of fork tube  
No ignition below 200% of peak level!

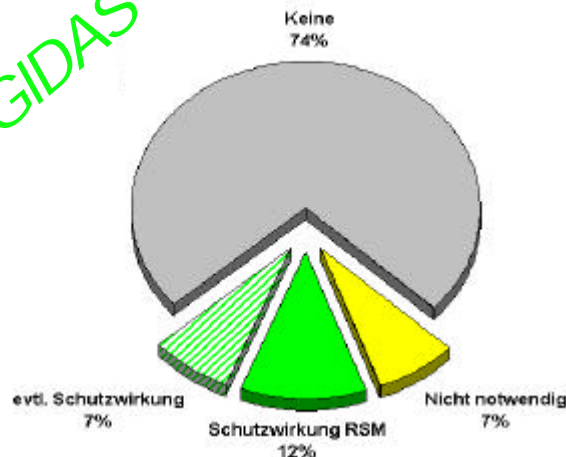


# Motorcycle Airbag Research at BMW

## Safety Potential Evaluation

Schutzwirkung RSM alle Unfalltypen

GIDAS



**Result:**  
**15,5 % Protection Potential**

### Detailed:

12 % Benefit  
3,5 % ½ possible Benefit

### Cases:

n = 162

Hinweis: Datenbank  
bei BMW ausgewertet

Schutzpotenzial RSM (alle Unfalltypen)

BMW



**Result:**  
**20.5 % Protection Potential**

### Detailed:

19 % Benefit  
1,5 % ½ possible Benefit

### Cases:

n = 280

Hinweis: Datenbank  
bei BMW ausgewertet

DEKRA

**Result:**  
**19 % Protection Potential**

### Detailed:

7 % Reduction of killed  
persons  
12 % Reduction of injured  
persons

### Cases:

n = 97

Quelle: DEKRA Holding AG; Bericht aus  
„Motorradreport“ 1996

# Research

## Airbag vest

- Combined development with Motorcycle Clothing manufacturers.  
⇒ **Airbag Vests**
- In the view of BMW Crash sensor technology does not hit the target jet. (Trigger Line!)  
⇒ **Reduction of serious Thorax injury**



# Research

## Combined Training Car / Motorcycle

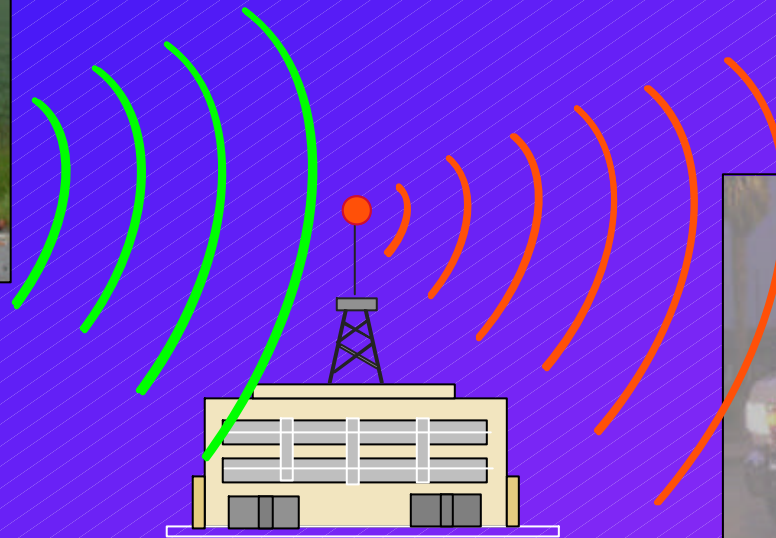


- First Pilot Projects inside BMW
- Car-Driver with Motorcycle licence are less involved in Car-MC accidents.
- Combination of Car and MC Training
  - ⇒ Car drivers gain knowledge of the dynamics of Motorcycles
  - ⇒ **reduction of Accidents**



# Research

## e-call (Autom. Crash Notification)



- Automatic emergency call similar to cars
- Reduction of the „golden hour“ (Time between crash and rescue)

⇒ **Improvement of the primary medical care!**

# Research

## e-safety (Intelligent Transportation Systems)



- Communication of street vehicles
  - Early recognition of critical situations
  - Alert of drivers
  - Pre-safety actions within the street vehicles
- ⇒ **reduction of accidents**
- ⇒ **increased Active Safety of Motorcycles**

# Research

## EU Project on „Active Safety of Motorcycles“







**Thank you for your attention !**